

# NOTES ON THE INCREASING PROPORTION OF NON-NATIVE ANGIOSPERMS IN THE MISSOURI FLORA, WITH REPORTS OF THREE NEW GENERA FOR THE STATE

George Yatskievych

Missouri Department of Conservation/  
Missouri Botanical Garden  
P.O. Box 299  
St. Louis, MO 63166, U.S.A.  
george.yatskievych@mobot.org

Jay A. Raveill

Department of Biology  
Central Missouri State University  
Warrensburg, MO 64093, U.S.A.  
jar8812@cmsu2.cmsu.edu

## ABSTRACT

Three additions to the Missouri flora are reported: *Fatoua villosa* (Moraceae), *Oenanthe javanica* (Apiaceae), and *Ottelia alismoides* (Hydrocharitaceae). Each of these represents a nonindigenous genus new to the state. The number of introduced taxa of vascular plants in Missouri continues to increase more rapidly than that of native taxa, and the non-native component of the state's floristic diversity has risen from ca. 22.8 percent to 27.7 percent during the past 35 years.

## RESUMEN

Se citan tres nuevas especies para la flora de Missouri: *Fatoua villosa* (Moraceae), *Oenanthe javanica* (Apiaceae), y *Ottelia alismoides* (Hydrocharitaceae). Cada una de éstas representa un género nuevo no autóctono para el estado. El número de taxones introducidos continúa incrementándose más rápidamente que el de los taxones nativos, y el componente no nativo de la diversidad florística del estado ha aumentado del 22.8 por ciento al 27.7 por ciento en los últimos 35 años.

There are many good reasons for establishing permanent programs to collect data on floristic diversity in various regions. Among these, perhaps the most surprising to non-botanists is that field and herbarium studies continue to yield major new distributional records, even in supposedly well-botanized areas. The notion that plants, unlike animals, are generally rooted in place has led to the flawed perception among some scientists, administrators, and politicians that plant distributions generally are static, and that inventory and monitoring activities reasonably may be curtailed following attainment of some qualitatively established benchmark, such as publication of a state floristic manual.

Actual facts counter this perception. For example, for many years, knowledge of the vascular flora of Missouri was considered by many botanists to be relatively complete, at least compared with that of most other states. Missouri had an exemplary floristic manual (Steyermark 1963), praised by botanists for its completeness and attention to detail. Steyermark's own extensive body of meticulously documented field work and more than 60,000 Missouri collections, along with the activities of a large number of other prolific collectors, resulted in one of the most thoroughly documented regional floras in the country.



Missouri's landlocked midcontinental position also contributed to the notion of stability of the state's flora.

Even before the publication of *Flora of Missouri*, however, additional species records began to accumulate. In fact, Steyermark (1963) was forced to add a 3-page addendum to his book to include mention of 20 species that been confirmed to occur in Missouri after his text had been finalized for the publisher, based on specimens newly accessioned in herbaria. Over time, a remarkable number of other additions to the register of the state's flora has been reported by a large number of workers. Yatskievych (1999) summarized these for the 35-year period following publication of Steyermark's *Flora* as comprising 292 species, 25 infraspecific taxa, and 21 hybrids, a net increase of 11.9 percent. He further noted that the amazing rate of nearly ten new taxa discovered per year showed no sign of slowing. The new records represent a mixture of relatively localized taxa overlooked by earlier botanists, recently established populations reflecting rapidly shifting or expanding ranges of some plants, and a few novelties only recently described as new to science. Turner and Yatskievych (1992) detailed the Missouri distributions of new records recorded from 1963 to 1991 and some additional records were discussed by Yatskievych (1999).

At the species level, 37 percent of these reports were of taxa considered to be native components of the flora, with the remaining 63 percent representing non-native taxa (Yatskievych 1999). Thus, during the three and a half decades following the publication of Steyermark's (1963) *Flora*, the non-native component of the state's floristic diversity rose from ca. 22.8 percent to 27.7 percent. It is worth noting that although most of the non-native additions to the flora have remained relative rarities, some of them have become quite common and widespread, including such weedy species as *Alliaria petiolata* (M. Bieb.) Cavara & Grande (Brassicaceae, garlic mustard), *Dipsacus laciniatus* L. (Dipsacaceae, cut-leaved teasel), *Elaeagnus umbellata* Thunb. (Elaeagnaceae, autumn olive), *Lonicera maackii* (Rupr.) Maxim. (Caprifoliaceae, Amur honeysuckle), and *Ligustrum obtusifolium* Sieb. & Zucc. and *L. sinense* Lour. (Oleaceae, privets). Some of the worst invasive exotics troubling property owners, land managers, and conservationists today were not known to grow in Missouri in 1963.

With this in mind, we present data to justify the inclusion of three recently found species in the flora of Missouri. The taxa are notable in that they represent new generic records for the state as well, and in one case, to our knowledge, the species previously has not been recorded for the North American flora. We believe that each of these species has the potential to become more widespread in Missouri and possibly to become invasive in some native plant communities in the state.

***Fatoua villosa*** (Thunb.) Nakai (Moraceae, mulberry weed).—This monoecious annual is native to eastern Asia, where it often occurs in disturbed habitats. It was first reported for North America from Louisiana by Thieret (1964), who indicated



that it may have been present in the New Orleans area for 15 or more years prior to his report. Since that time, it has become widespread in the southeastern and midwestern states west to Texas and has appeared sporadically in Utah, California and Washington, as well as Hawaii, Puerto Rico, and the Bahamas. For reviews of the literature on its geographic spread, see Vincent (1993) and Kartesz and Meacham (1999). Reports of occurrences in Indiana (Wunderlin 1997; Kartesz & Meacham 1999) require confirmation.

*Fatoua villosa* is a nondescript herb with alternate, petiolate, stipulate, ovate to triangular leaves having truncatate to cordate bases, crenate margins, and attenuate tips. The vegetative portions strongly resemble seedlings or root sprouts of mulberries (*Morus* spp.), hence the common name "mulberry weed." The dense, flattened, brownish purple cymes containing both staminate and pistillate flowers somewhat resemble a reduced version of a *Dorstenia* (Moraceae) inflorescence. The flowers mature at different times, so the tiny projectile seeds are dispersed over at least a two month period (pers. obs. in Missouri). Wunderlin (1997) provided a description and keys to separate *Fatoua* from other genera of North American Moraceae.

Mulberry weed is most commonly found in greenhouses, flower beds, and similar highly disturbed sites. Much of its interstate spread may be in the form of seeds residing as contaminants in nursery stock and soil or mulch. The strong superficial similarities between the herbage to that of *Morus* suggests that plants of *Fatoua* may be overlooked by some collectors and that the species' range might be greater than has been documented thus far.

In Missouri, *Fatoua villosa* was first brought to the authors' attention by Dr. Michael Vincent of Miami University, who had studied the species' distribution in Ohio (Vincent 1993), and who noted plants in flower beds at the Missouri Botanical Garden while attending a symposium in October, 1993. Subsequent herbarium studies disclosed that the species was present as early as 1990 as a greenhouse weed at the Botanical Garden. By 1994, the plant had become a troublesome pest in planted areas around the property and the horticulture staff began an aggressive campaign to weed it out. Despite the efforts of staff and volunteers since then, the plants have merely decreased in numbers and size and not been eliminated, presumably because of a soil seed bank. Indeed, by 1996 the species had spread to the Garden's Shaw Nature Reserve, in Franklin County, where it became established in tended woodland areas. Other weedy occurrences noted in flower beds at various locations in and around St. Louis City and County presumably resulted from independent introductions into the state. However, based on a survey of herbarium specimens, the species was present as early as 1972 as a greenhouse weed in Cape Girardeau. In recent years, localized infestations have been documented from additional counties, and the species eventually may be found in most metropolitan areas around the state. Its invasive potential remains to be determined, but it is worth noting that it



has been collected along disturbed margins of at least one mesic upland forest site in St. Louis County.

Specimens examined: U.S.A. **Missouri. Boone Co.:** Columbia, 608 E. Cherry Street, common weed along edge of perennial evergreen shrubbery at NW corner of Federal Building, 24 Aug 1995, *McKenzie 1629* (MO, UMO). **Butler Co.:** Poplar Bluff, 252 S Barron Road, weed in flower bed of residence, present for at least 2 years, 17 Sep 1994, *Hudson s.n.* (MO); Poplar Bluff, near steps leading from E parking lot of Kneibert Clinic to parking lot, at edge of lawn, 26 Aug 1996, *Hudson 956* (MO). **Cape Girardeau Co.:** Cape Girardeau; Brooks Gardens, 1110 N Cape Rock Drive, weed in greenhouse, 24 Sep 1972, *Brooks s.n.* (MO, SEMO). **Cole Co.:** Jefferson City, Missouri Department of Conservation Headquarters, in mulched plantings of courtyard within office complex, 7 Aug 2000, *Smith 3605* (MO). **Franklin Co.:** Gray Summit, Shaw Arboretum, Whitmire Wildflower Garden in shaded bed near gazebo at S end of small pond, scattered weeds in planting, 14 Sep 1996, *Yatskievych & Yatskievych 96-82* (MO). **St. Louis Co.:** St. Louis City, Missouri Botanical Garden, weed in greenhouse, 19 Sep 1990, *Miller, Merello, & Schmidt 5608* (MO); Missouri Botanical Garden, weed in flower bed in front of Climatron, 9 Oct 1993, *Vincent 6443* (MO, MU); Missouri Botanical Garden, along edge of main walk from Ridgway Center to Climatron, uncommon weed in bed, presumably introduced as a seed contaminant in *Zinnia* planting, 9 Oct 1993, *Yatskievych & Yatskievych 93-371* (MO); Missouri Botanical Garden, weed on W side of Schoenberg Administration Building, 30 Aug 1995, *Lievens, Yatskievych, & Yatskievych 5770* (MO); Clayton; SW corner of Forsyth Blvd. and Bemiston Rd., scattered weeds in planting along bank building, 7 Sep 1996, *Yatskievych & Yatskievych 96-80* (MO); Manchester, 957 Barcroft Woods Ct., uncommon along disturbed margin of mesic upland forest adjacent to back yard, 25 Oct 2000, *Yatskievych & Yatskievych 00-99* (MO).

***Oenanthe javanica*** (Blume) DC. (Apiaceae, water celery).—American horticulturalists continue to search abroad for hardy new plants to promote for use in gardens in the United States. This is especially true in water gardening, where there is a strong trend to utilize “specimen plants” exhibiting unusual growth forms. The water dropwort genus, *Oenanthe*, contains perhaps 40 species of mostly Old World perennials, a few of which have made their way into plant commerce (Mabberley 1997). Most of the species contain a number of toxic compounds (mostly polyacetylenes), and the vernacular “dropwort” generally has been used to denote plants responsible for animal or human poisoning. Thus, some species have been cultivated on a small scale for medicinal, pharmaceutical, or biochemical investigations.

The most commonly cultivated species of *Oenanthe* have been recorded as localized escapes: *O. aquatica* (L.) Poir. (water fennel), from Franklin County, Ohio (Cooperrider 1995); and *O. pimpinelloides* L., from Humboldt County, California (Constance 1993). To these, we now add *O. javanica*, from Johnson County, Missouri, apparently the first report of this species’ establishment outside of cultivation in North America.

*Oenanthe javanica* is a native of southeastern Asia and the Indo-Malaysian region. As North American botanists may be unfamiliar with the species, the following description has been adapted from the treatment in the forthcoming dicot volume of Steyermark’s *Flora of Missouri* (Yatskievych, in prep.):

Plants perennial, glabrous, with fibrous roots, lacking tubers. Stems 30–150



cm or more long, spreading with ascending branches and tips, somewhat inflated, rooting at the lower nodes. Leaves alternate and sometimes also basal, short- to long-petiolate, the petioles somewhat inflated. Leaf blades 3–20 cm long, ovate to triangular-ovate in outline, pinnately 1–2(–3) times compound, the leaflets 10–50 mm long, narrowly lanceolate to broadly ovate, rounded, narrowed, or tapered (sometimes unequally so) at the base, finely to more commonly coarsely toothed along the margins, occasionally with 1 or 2 basal lobes. Inflorescence an umbel, opposite the leaves and occasionally also terminal, mostly long-pedunculate. Involucre absent or less commonly of 1 or 2 bracts, these shorter than the rays, spreading to ascending at flowering, linear, with sharply pointed tips. Rays (4–)6–20, 0.5–3.0 cm long, strongly angled and with entire or minutely toothed, pale angles or narrow wings. Involucel of 7–13 bractlets, these shorter than to more commonly longer than the pedicels, linear, sometimes with thin, white, papery margins, tapered to sharply pointed tips. Flowers 5 to numerous in each umbellet, all perfect, epigynous, the pedicels 1–5 mm long. Sepals 5, minute triangular teeth. Petals 5, obovate, appearing shallowly notched apically but narrowed abruptly to a slender pointed extension at the tip, white. Ovary inferior, 2-carpellate, glabrous. Fruit a schizocarp, sometimes shed while still green, 2–3 mm long, oblong in outline, somewhat flattened laterally, glabrous, the 2 mericarps each with 5 ribs, these blunt, and broad, tan or light yellow to straw-colored, all or mostly obscuring the reddish brown surfaces between them.

This species was first collected in Missouri in 1996 by Lisa Wilson, a student in the plant taxonomy class at Central Missouri State University, but initially went unrecognized as a new record. Confirmation of its identity required collection of fruiting material during the 2000 field season. All collections originated from Race Horse Lake, a 0.73 ha (1.8 acre) artificial lake in the Pertle Springs Biological Study Area, owned by Central Missouri State University and located in Warrensburg, Johnson County. The population, which apparently originated near a bridge on the southern side of the lake, has been monitored since 1997 and has spread to occupy the entire shoreline of the lake. There are no records of its intentional cultivation at the site and the circumstances of its establishment there are not known. The species occurs as an emergent aquatic, with common associates including *Polygonum hydropiperoides*, *P. sagittatum*, *Schoenoplectus atrovirens*, *Boehmeria cylindrica*, and *Bidens cernua*. Its potential for becoming a serious weed is apparent in a 20 × 50 m, seasonally-inundated area along the southern side of the lake, where it forms a near monoculture. However, it is a minor vegetational component where steep slopes limit the littoral zone to a narrow strip. *Oenanthe javanica* has not spread to other ponds and lakes in the drainage, but is found in pockets of soil in the concrete spillway that drains Race Horse Lake and leads directly to the adjacent 6 ha (15 acre) Cena Lake. Future spread will be monitored and a plan to eliminate the population of



*Oenanthe* is being formulated by the CMSU Facilities and Grounds personnel in consultation with the Biology Department faculty.

Water celery is unusual in the genus *Oenanthe* in its edible herbage, and the species has a long history of cultivation in southeastern Asia and Malesia as a vegetable and potherb. Its adoption into North American horticulture apparently has been relatively recent, and the species was not included in *Hortus Third* (Liberty Hyde Bailey Hortorium staff 1976). Its popularity has risen in the last few years and cultivars have begun appearing on the market, such as 'Flamingo' with pinkish foliage. One indication of its popularity is that a recent search of the World Wide Web yielded about 65 sites including mention of the genus *Oenanthe*, principally online nursery catalogs. Some of these nursery catalogs include comments on the potential aggressiveness and vegetative spread of the species in some garden situations. That it can be dispersed by seed is evidenced from our conversations with horticulture staff at two botanical gardens in Indiana and Missouri, where plants grew spontaneously as contaminants in plantings of other aquatic species.

It should be noted that there is no modern monograph of *Oenanthe*. Several taxa originally treated as separate species have been reduced to infraspecific status by more recent workers, (e.g., Murata 1973). If one accepts the taxonomic validity of multiple varieties in this morphologically plastic taxon, then Missouri materials (and horticultural materials in the United States in general) should be referred to var. *javanica*, as currently circumscribed. Additionally, in working to determine the Missouri materials, we were surprised at the similarities between *O. javanica* and the North American native, *O. sarmentosa* C. Presl ex DC. (Pacific water dropwort), which occurs in wetlands mostly near the coast from Alaska to California. This species has been brought into cultivation locally within its native range, but apparently has not been marketed outside the Pacific Northwest. Regrettably, the only treatment thus far to attempt to contrast the two species is that of Hiroe (1979), whose key separated them on the basis of subtle differences in involucre and involucre size and shape, which are variable in both taxa. Future monographers may determine that *O. javanica* and *O. sarmentosa* should be combined into a single species with a disjunct distribution around the Pacific Rim.

Specimens examined: U.S.A. **Missouri. Johnson Co.:** Warrensburg, Pertle Springs, Race Horse Lake, 6 Oct 1996, *Wilson 113* (MO); same locality, 17 Aug 2000, *Raveill 3175* (MO, NEMO, SEMO, UMO, WARM); same locality, 26 Aug 2000, *Raveill 3176* (MO, NEMO, SEMO, UMO, WARM).

**Ottelia alismoides** (L.) Pers. (Hydrocharitaceae, duck lettuce).—The pantropical genus *Ottelia* comprises 21 mostly Old World species of aquatic annuals and perennials (Cook et al. 1984; Cook & Urmi-König 1984). One species, *O. alismoides*, which is native from Asia to Australia, has become widely established as an aquatic weed in parts of Africa, Europe, and North America. In the



United States, where the U.S. Department of Agriculture has listed the species as a federal noxious weed, it was first reported from southwestern Louisiana (Holmes 1978), where it was collected in 1939 (Haynes, 2000) and apparently remains well-naturalized in lakes and reservoirs in five parishes (Thomas & Allen 1993). Hatch et al. (1990) reported it from adjacent southeastern Texas without citation of localities or vouchers. A population in Butte County, California, in a ditch associated with rice fields was exterminated even before it could be reported in the literature (Turner 1980). The report from Missouri is the first example of a population occurring at a significantly inland location.

*Ottelia alismoides* is a short-stemmed, robust, submerged aquatic with large, long-petiolate, mostly ovate-cordate leaves resembling those of a plantain (*Plantago*) or water plantain (*Alisma*). The long-pedunculate, 1-flowered, emergent inflorescences are enclosed basally in a spathe with several undulate wings or ribs. The usually perfect flowers have 3 showy (2–3 cm long) white to pale pink petals. For more complete descriptions of this species and keys to its determination, see Godfrey and Wooten (1979), Cook and Urmi-König (1984), and Haynes (2000).

In July 2000, a population of *Ottelia* was located in southeastern Missouri by herpetologist Jeff Briggler, who, with other biologists from the Missouri Department of Conservation, was conducting reptile and amphibian surveys in two adjacent artificial wetlands at the Big Cane Conservation Area, in Butler County. These sites had been excavated in 1998 to create marsh habitat for the state-endangered western chicken turtle (*Deirochelys reticularia miaria*). There is no evidence that propagules of *Ottelia* were transported to the site accidentally on the equipment used for the excavations, so the plants are presumed to have been introduced into the area by migratory waterfowl. The shallow depressions in sandy soil presently contain a young successional wetland plant community, including individuals and patches of such associates as *Alisma triviale*, *Azolla mexicana*, *Echinodorus cordifolius*, *Eleocharis* spp., *Heteranthera* spp., *Ludwigia peploides*, *Myriophyllum pinnatum*, *Potamogeton foliosus*, *Sagittaria calycina*, and *Sphenoclea zeylanica*. Plants of *Ottelia* originally were noted flowering in the northernmost of the two areas, but a subsequent visit by local botanist Stanton Hudson (who is completing a floristic survey of Butler County) disclosed a few plants in the more southern area as well. Other sites in the vicinity have not been searched yet for the presence of duck lettuce. The Missouri Department of Conservation is preparing to attempt the eradication of plants at the known sites and to survey for the occurrence of duck lettuce in adjacent areas. In addition to the possibility that *O. alismoides* may spread to natural wetlands in the southern portion of the state, the potential exists for this species to invade rice fields in Missouri's Bootheel.

Specimens examined: U.S.A. **Missouri. Butler Co.:** Big Cane Conservation Area, ca. 3 mi S of Neelyville, ca. 1/3 mi NNW of parking lot on County Rd 278, in water of shallow man-made marshes, 27 Jul 2000, Briggler, Pelton, Johnson & Urich s.n. (MO, UMO); same locality, 12 Sep 2000, Hudson 1287 (MO).



## ACKNOWLEDGMENTS

The authors wish to thank the following individuals, who provided information and/or review toward one or more of the reports in this paper: Missouri Department of Conservation Biologists Jeff Brigler, Karen Kramer, Tim Smith, and David Urich; U.S. Fish & Wildlife Service Biologist Paul McKenzie; Stan Hudson, formerly of Poplar Bluff; Becky Sucher, plant recorder at Missouri Botanical Garden; David Bauman, botanist at White River Gardens; and Mike Vincent, of Miami University.

## REFERENCES

- CONSTANCE, L. 1993. Apiaceae [Umbelliferae], carrot family. In: J.C. Hickman, ed. The Jepson manual, higher plants of California. University of California Press, Berkeley. Pp. 136–166.
- COOK, C.D.K. and K. URMİ-KÖNIG. 1984. A revision of the genus *Ottelia* (Hydrocharitaceae) 2. The species of Eurasia, Australasia, and America. Aquatic Bot. 20:131–177.
- COOK, C.D.K., J.-J. SYMOENS, and K. URMİ-KÖNIG. 1984. A revision of the genus *Ottelia* (Hydrocharitaceae) I. Generic considerations. Aquatic Bot. 18:263–274.
- COOPERRIDER, T.S. 1995. The Dicotyledoneae of Ohio. Part 2: Linaceae through Campanulaceae. Ohio State University Press, Columbus.
- GODFREY, R.K. and J.W. WOOTEN. 1979. Aquatic and wetland plants of southeastern United States. Monocotyledons. University of Georgia Press, Athens.
- HATCH, S.L., K.N. GANDHI, and L.E. BROWN. 1990. Checklist of the vascular plants of Texas. Texas Agric. Exp. Stat. Publ. MP-1655, College Station.
- HAYNES, R.R. 2000. Hydrocharitaceae Jussieu, tape-grass or frog-bit family. In: Flora of North America Editorial Committee, eds. Flora of North America north of Mexico. Volume 22. Magnoliophyta: Alismatidae, Arecidae, Commelinidae (in Part), and Zingiberidae. Oxford University Press, New York. Pp. 26–38.
- HIROE, M. 1979. Umbelliferae of World. Ariake Book Co., Tokyo.
- HOLMES, W.C. 1978. Range extension for *Ottelia alismoides* (L.) Pers. (Hydrocharitaceae). Castanea 43:193–194.
- KARTESZ, J.T. and C.A. MEACHAM. 1999. Synthesis of the North American flora, version 1.0. North Carolina Botanical Garden, Chapel Hill [CD-ROM].
- LIBERTY HYDE BAILEY HORTORIUM STAFF. 1976. Hortus third. MacMillan Publishing Co., New York.
- MABBERLEY, D.J. 1997. The plant book, a portable dictionary of the vascular plants, second edition. Cambridge University Press, Cambridge, Great Britain.
- MURATA, G. 1973. New or interesting plants from Southeast Asia 1. Acta Phytotax. Geobot. 25:97–106.
- STEYERMARK, J.A. 1963. Flora of Missouri. Iowa State University Press, Ames [errata added at second printing, 1968].
- THIERET, J.W. 1964. *Fatoua villosa* (Moraceae) in Louisiana: new to North America. Sida 1:248.
- THOMAS, R.D. and C.M. ALLEN. 1993. Atlas of the vascular flora of Louisiana. Volume I: Ferns and fern allies, conifers, & monocotyledons. Louisiana Department of Wildlife and Fisheries, Baton Rouge.



- TURNER, C.E. 1980. Noteworthy collections. *Ottelia alismoides* (L.) Pers. (Hydrocharitaceae). Madroño 27:177.
- TURNER, J. and G. YATSKIEVYCH. 1992. County record vouchers for vascular plant species newly recorded for Missouri since 1963. Missouriensis 13:1–24.
- VINCENT, M.A. 1993. *Fatoua villosa* (Moraceae), mulberry weed, in Ohio. Ohio J. Sci. 93:147–149.
- WUNDERLIN, R.P. 1997. Moraceae Link, mulberry family. In: Flora of North America Editorial Committee, eds. Flora of North America north of Mexico. Volume 3. Magnoliophyta: Magnoliidae and Hamamelidae. Oxford University Press, New York. Pp. 388–399.
- YATSKIEVYCH, G. 1999. Steyermark's flora of Missouri, revised edition, volume 1. Missouri Department of Conservation, Jefferson City.